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FERAL BURROS ON THE HAVASU RESOURCE AREA, COLORADO RIVER VALLEY, CALIFORNIA - ARIZONA

Semi-Annual Report Submitted to
The U. S. Bureau of Land Management

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by

Robert D. Ohmart, Susan L. Woodward and Rick Seegmiller
Dept. of Zoology, Arizona State University, Tempe, Arizona

Introduction

Eighteen months research on feral burros has been completed in the Havasu Resource Area. Cumulative data permit calculation of home ranges, a quantification of habitat use, a tentative appraisal of reproductive rates, and an ageing criterion for animals between 0 and 18 months. The 1974 diet of burros in the Chemehuevi Mountains, California, based on fecal analysis conducted by the Fecal Composition Analysis Laboratory at Arizona State University, has been determined and is included in this report as well.

Home Ranges

Minimum home ranges have been delineated for fifteen marked burros in the Chemehuevi Mountains study area (Figures 1 - 11). The polygon method of mapping and connecting the most distant points at which an individual was sighted and then measuring the circumscribed area with a planimeter was used.

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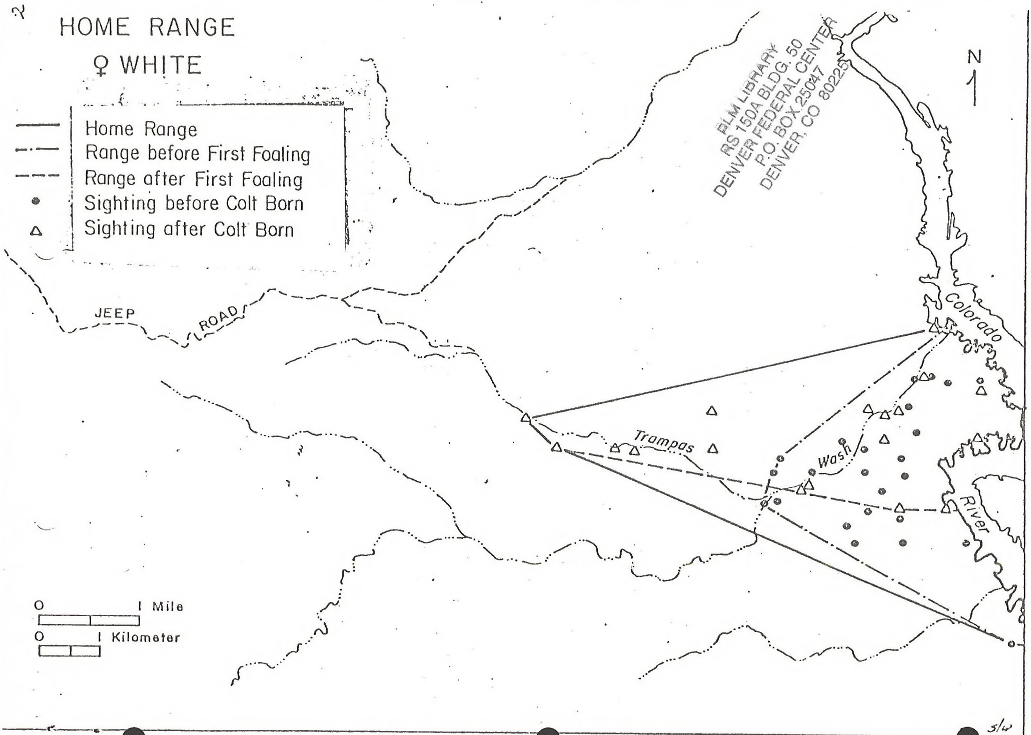
HOME RANGE
♀ WHITE



—— Home Range
—·— Range before First Foaling
— — Range after First Foaling
● Sighting before Colt Born
△ Sighting after Colt Born
N
JEEP ROAD
Trampas Wash
Colorado River
0 1 Mile
0 1 Kilometer

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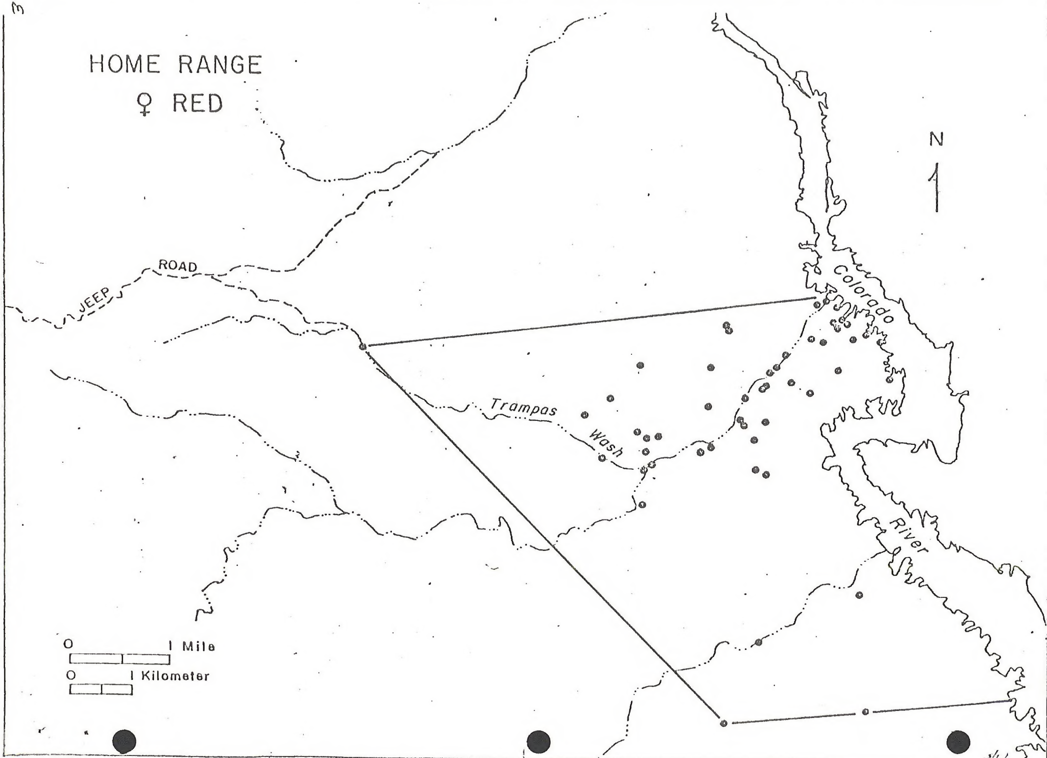
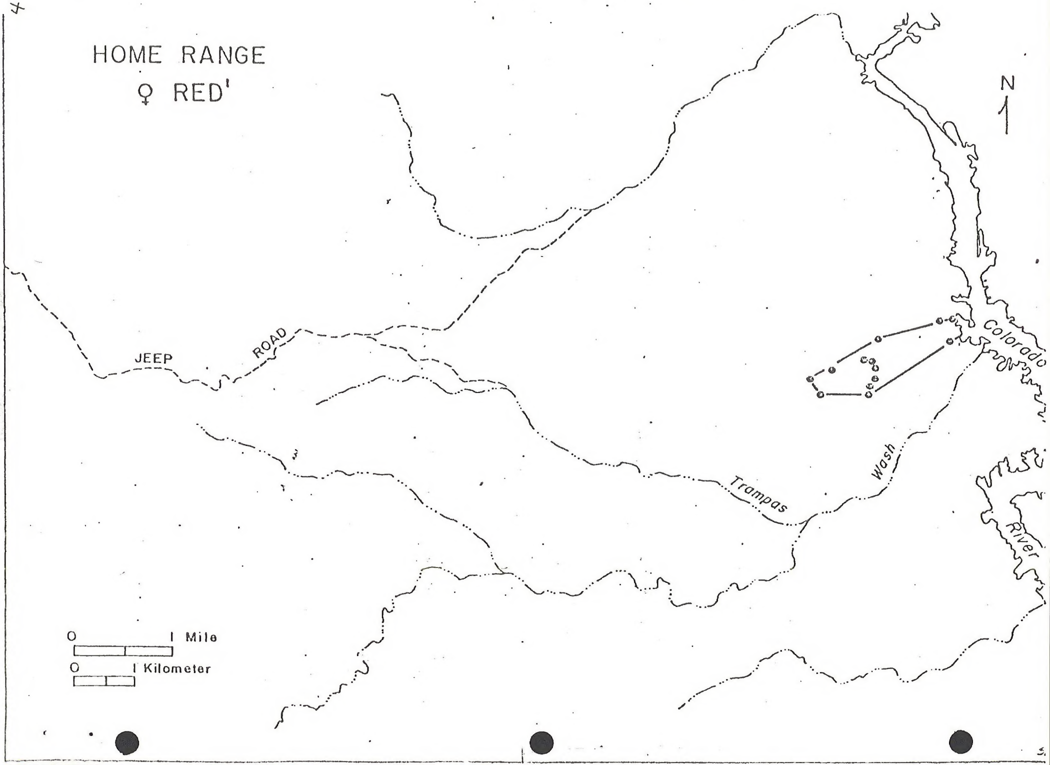
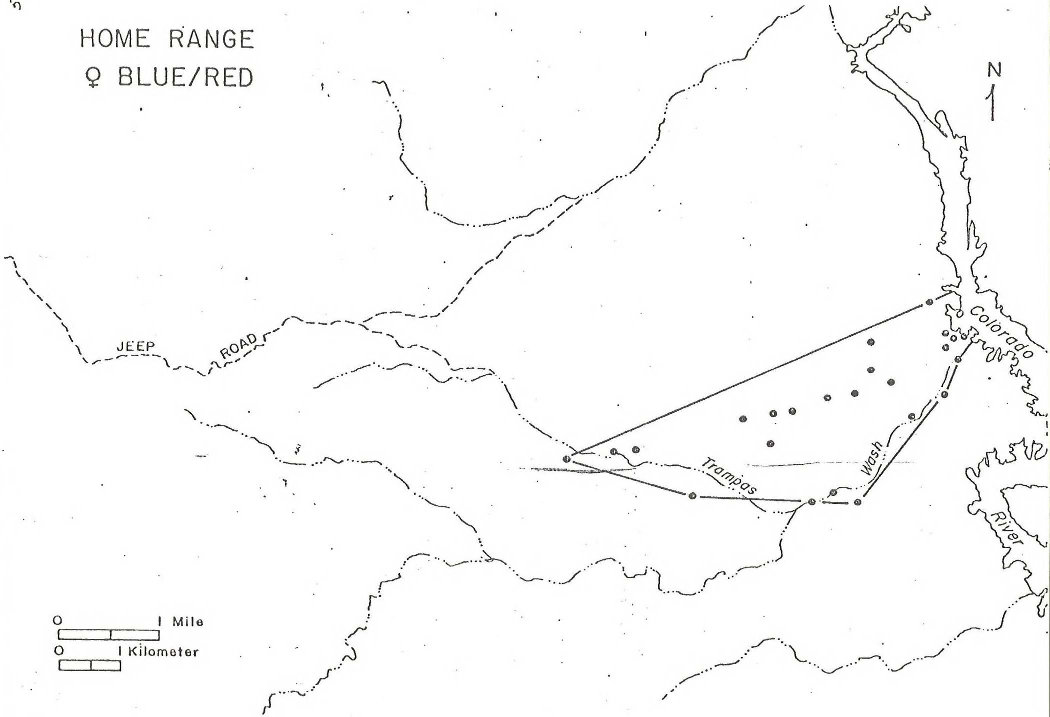


HOME RANGE
♀ RED

HOME RANGE
♀ RED'



HOME RANGE
♀ BLUE/RED



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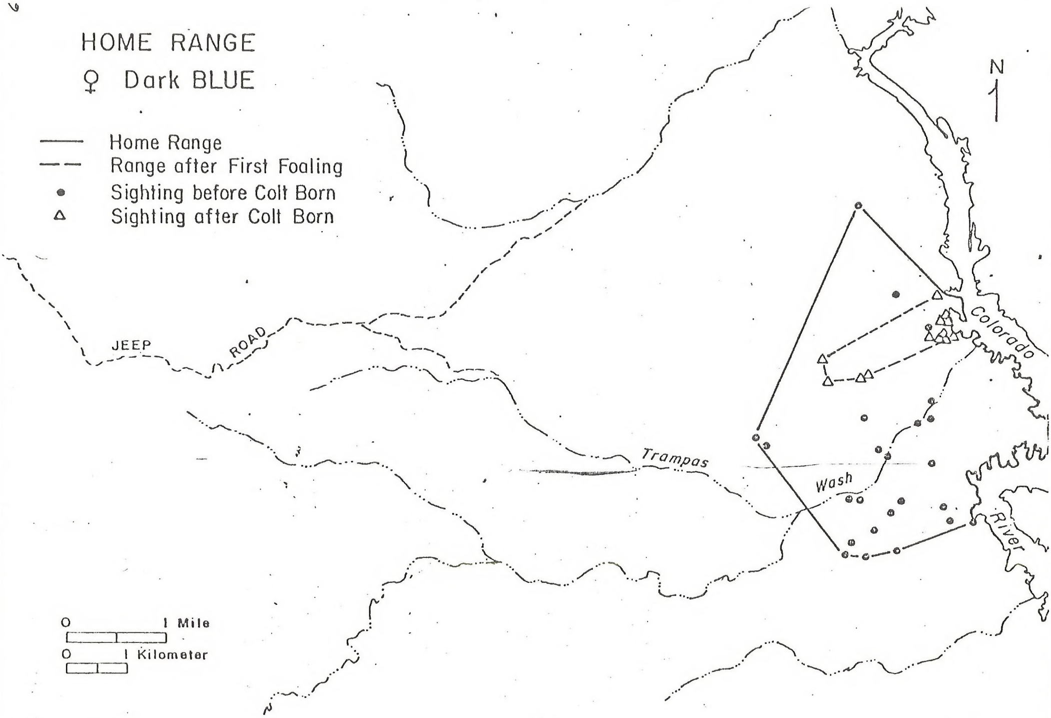
HOME RANGE
♀ Dark BLUE


—— Home Range
– – Range after First Foaling
● Sighting before Colt Born
△ Sighting after Colt Born
N
JEEP ROAD
Trampas Wash
Colorado River
0 1 Mile
0 1 Kilometer

5/W

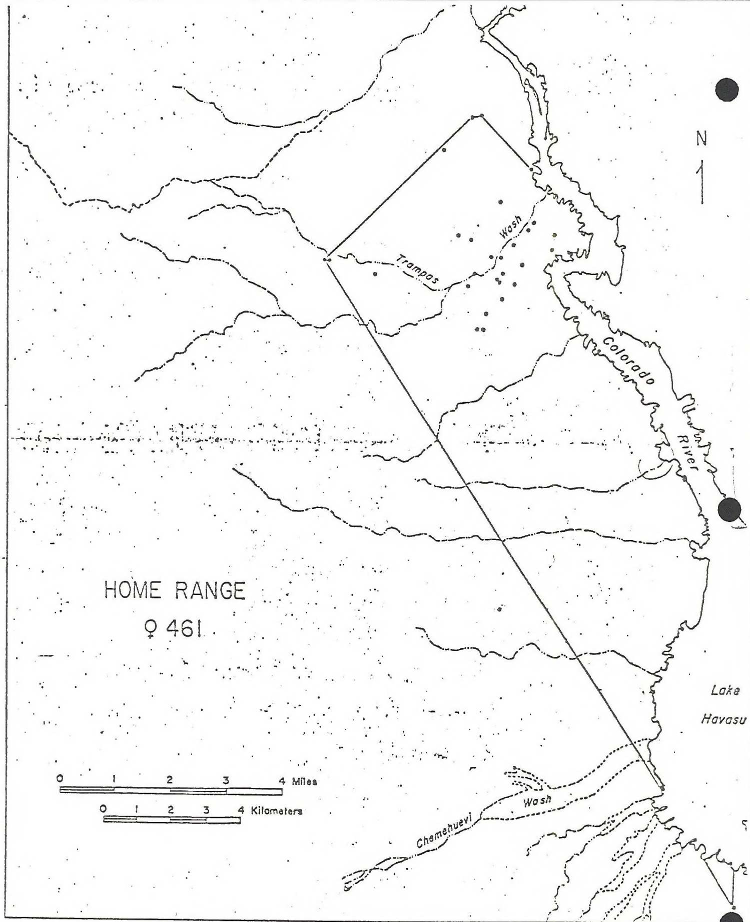
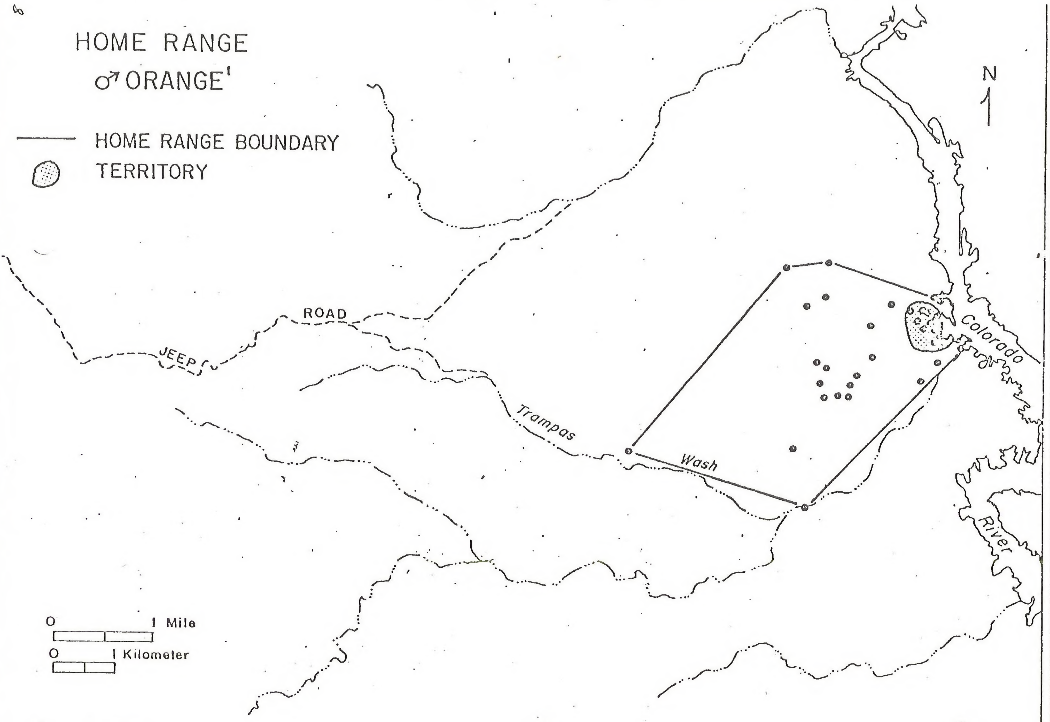
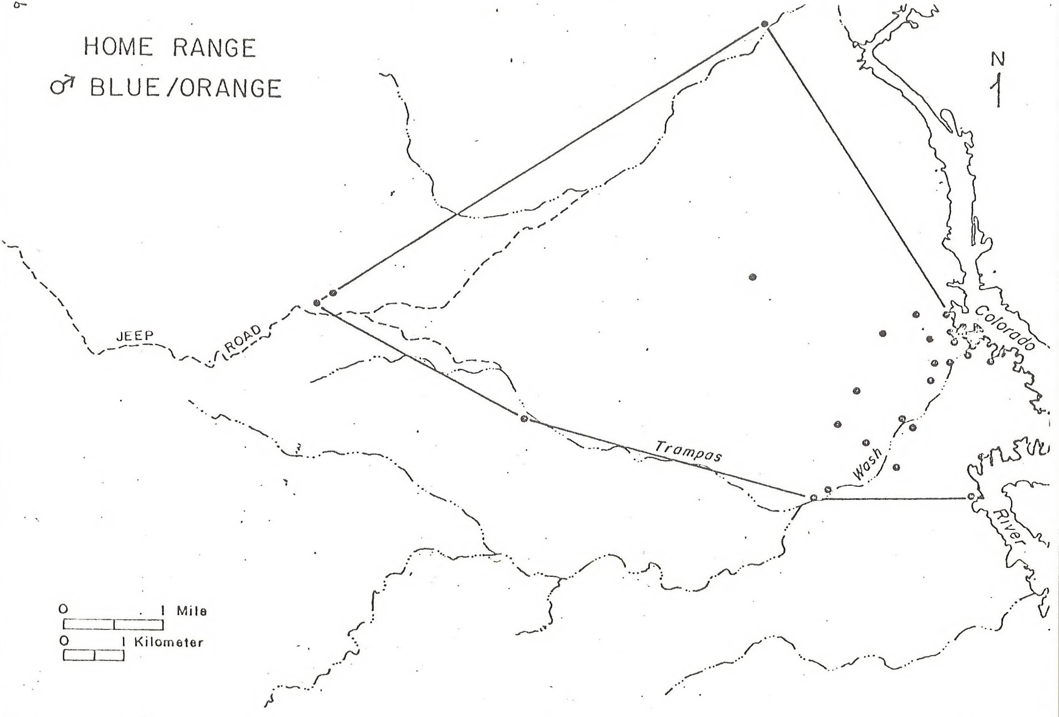


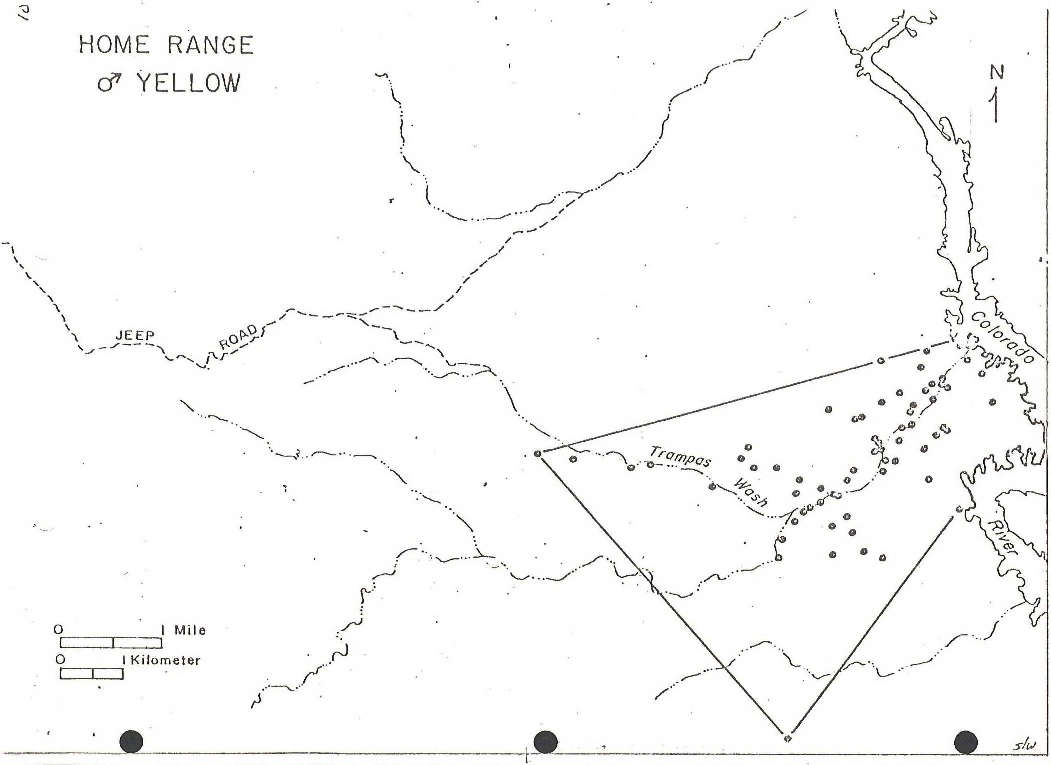
Figure 6. Home range of female 461.


HOME RANGE
♂ ORANGE¹
HOME RANGE BOUNDARY
TERRITORY
N
ROAD
JEEP
Trampas
Wash
Colorado
River
0 1 Mile
0 1 Kilometer

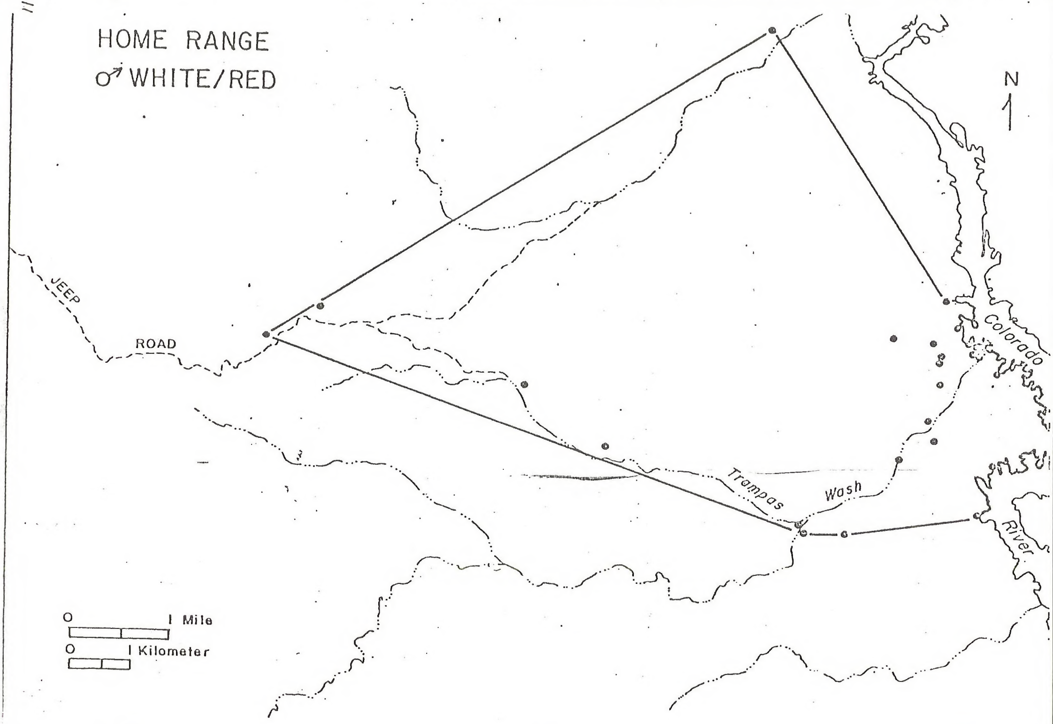


HOME RANGE
♂ BLUE/ORANGE

HOME RANGE
♂ YELLOW



HOME RANGE
♂ WHITE/RED



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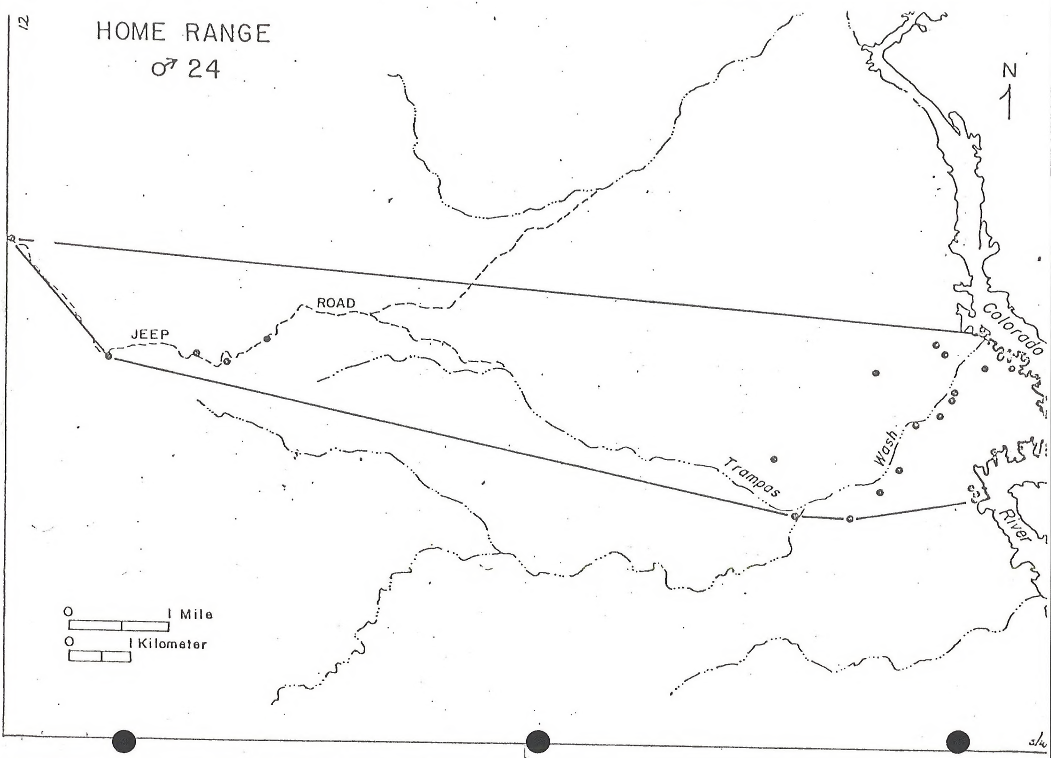
HOME RANGE
♂ 24



Only burros which had been located at least ten times over a period greater than 6 months were considered (Table 1). Home range sizes varied from 0.5 to 38.00 square miles, with a mean of 11.58 square miles. There was no significant difference between the means of females' and males' home ranges (Student's t test, $p = 0.05$).

The smallest male home range was that of jack ORANGE', which had displayed strong territorial behavior in the summer of 1974 (Figure 7). Interestingly, a jenny which frequented the territory that summer, Female RED, had the smallest female home range. Female DARK BLUE, which first foaled on the territory in July 1974, has had a home range restricted to 0.76 square miles since then. The territory is included in that range. It should be pointed out that three unmarked jennies which were also regularly on the territory in 1974 did not limit themselves to its vicinity the following fall, winter and spring. The attachment of the two collared females to such a restricted area may be only an expression of individual variation and not attachment to the territory or the territorial male.

The largest home range belonged to the ten to eleven-year old Female 461 (Figure 6). Her total home range is probably much larger than the 38.00 square miles the polygon method allows. Only one sighting was made to the far south of the range, and she had to have used a broader area for foraging and watering than one point can show.

TABLE 1. Burro home ranges in the Ch[illegible]ehuevi Mountains, California in 1974-75

Burro	Number of Sightings	Length of Record (Months)	Longest Axis (Miles)	Area of Home Range (Sq.Miles)
HOME RANGES: JENNIES				
461	27	12	15.00	38.00
WHITE	36	18	5.38	7.65
RED	45	18	6.13	15.44
DARK BLUE	32	18	3.50	5.76
RED'	12	10	1.50	0.50
BLUE/RED	26	11	4.13	4.16
HOME RANGES: JACKS				
YELLOW	74	17	4.63	9.97
466	63	17	4.25	7.60
13	32	14	6.00	10.11
WHITE/RED	27	12	7.25	20.56
WHITE'	36	9	4.50	8.00
BLUE/ORANGE	36	10	7.00	17.85
ORANGE'	36	12	3.50	4.54
RED/YELLOW	15	12	5.50	7.05
2	17	12	10.00	15.40

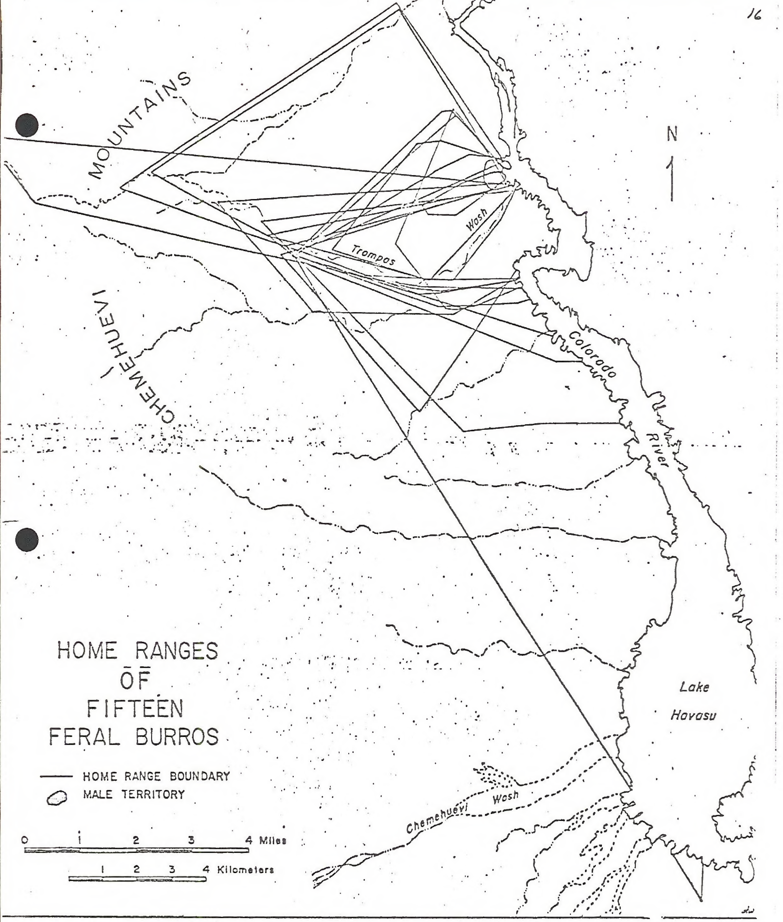
The mean home range of Chemehuevi Mountains burros is considerably larger than that of Death Valley burros (4.06 square miles). The Death Valley population was similar in that a great deal of individual variation was observed in home range sizes; however, home ranges varied between 0.5 and 15.67 square miles (Moehlman 1974). The Colorado River may give the Chemehuevi herd greater freedom of movement, although in most instances the longest axis of a home range is oriented perpendicular and not parallel to the course of the Colorado River. More likely the sparser vegetation of the Chemehuevi Mountains (The Death Valley study was conducted at elevations of 4,000 to 9,000 feet.) necessitates broader movements.

No distinct pattern of home range use was discernible, other than seasonal movements toward or away from the river.

All the home ranges overlapped, and some are entirely contained within others (Figure 12). The loose social structure and the instability of most social groups reflects this non-exclusive pattern of home ranges.

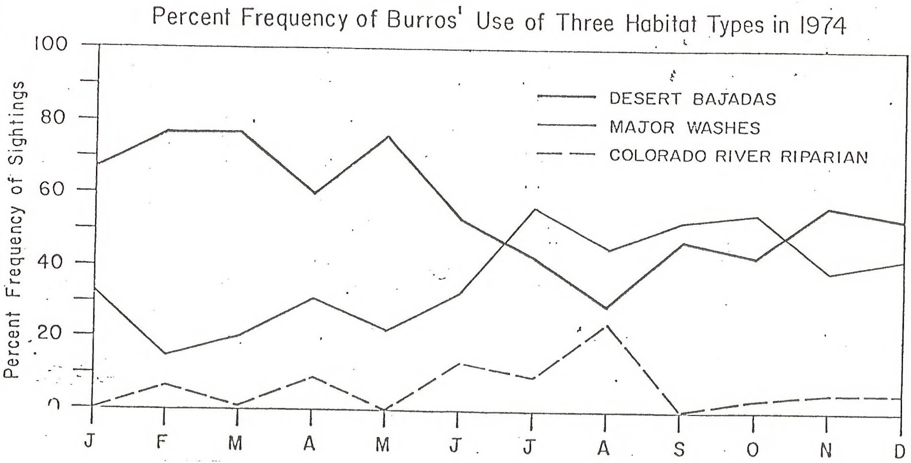
Habitat Use in 1974

Figure 13 shows the percent frequency with which burros were sighted in three habitat types during each month of 1974. In January through March, burros were foraging almost exclusively on the interfluves. The major washes were used to gain access to the Colorado River, and the riparian zone was entered only when passing to the river to water. Very



gure 12. Composite of the home ranges of burros from Figures 1 - 11.

Figure 13. Burro use of three habitat types in the Chemeheuvi Mountains, California.



little feeding took place in either the washes or the riparian habitat.

By mid-June burros were rarely seen on the interfluves during daylight hours. By that time ambient temperatures surpassed 120° F. in the afternoons, and burros sought shade under palo verdes, mesquites and salt cedars. They did graze on the bajadas at night, however. The mesquite bean crop apparently attracted the burros into the riparian zone in July and August. During the hotter days of June, before the beans were ripe, burros were much more apt to loaf in the shade under palo verdes in the washes than in the denser and cooler riparian vegetation.

Probably due to the depletion of cured annuals (particularly Plantago insularis) resulting from heavy grazing and two years' drought, burros spent less time on the bajadas in the winter of 1974-75 than the previous year. However, when a sparse cover of annuals finally sprouted in late March and April 1975, the burros again confined most of their foraging to the bajadas.

Diet

Thirty-nine plant species (including four unknowns) were identified in the burro diet for 1974 (Table 2). Desert wheat grass (Plantago insularis) and palo verde (Cercidium floridum) were by far the most salient components. Together with arrowweed (Pluchea sericea) and mesquite (Prosopis spp.), they formed over fifty percent of the annual diet. However, predominance in the diet varied seasonally among these four species. The annual Plantago responds to winter precipitation;

Table 2. Burro Diet* - Chemehuevi Mountains, California, 1974.

	Jan. (17)	Feb. (4)	Mar. (3)	Apr. (8)	May (8)	June (5)
GRASSES						
Aristida spp.		0.27	0.57	0.48		
Muhlenbergia porteri		0.27				
Bromus rubens				1.46	0.22	
Schismus barbatus			1.38	4.79		
Tridens pulchellus				0.32		
Sorghum spp.		0.56	0.21	0.64		
TOTAL	0.00	1.10	2.16	7.69	0.22	0.00
FORBS						
Eriogonum spp.	0.54	5.79	0.72	0.32	3.07	4.77
Mirabilis					0.89	
Mentzelia spp.			0.43			
Oenothera spp.	0.27	0.83	7.94	3.53		
Langloisia setosissima		0.27				
Pectocarya spp.						
Amsinkia/Cryptantha	7.90	7.34	4.02	3.17	4.02	5.14
Mimulus biglovii	4.02	4.88				
Plantago insularis	9.95	26.94	64.39	50.38	41.92	27.39
Geraea canescens		0.27		0.32	2.02	
Calycoseris wrightii		0.56		0.48		
TOTAL	26.85	46.88	77.53	58.20	51.92	37.30
SHRUBS						
Cercidium floridum	16.08	6.10	1.00	2.31	2.95	11.82
Cassia armata		0.27				1.35
Prosopis spp.	2.31	2.53	0.64	4.61	6.12	8.62
Acacia greggii	5.03		1.15	1.29	2.37	0.55
Dalea schottii	3.88	1.67	0.21			
Krameria grayi	0.81	0.83		5.17	3.19	6.65
Larrea divaricata		1.67	2.90	1.97		

Table 2. (continued)

SHRUBS (continued)	Jan.	Feb.	Mar.	Apr.	May	June
Sphaeralcea ambigua	1.90					
Fouquieria splendens	4.17	6.10	2.36	1.13	0.89	0.89
Opuntia acanthocarpa	7.59	1.11	2.75	2.65	3.78	
Hyptis emoryi	0.40	0.27		0.16		1.35
Lycium andersonii	2.60	3.70	0.14	0.80		0.45
Hymenoclea salsola	6.37	3.99	4.18	5.92	1.00	4.40
Encelia farinosa	3.31			0.96	1.56	0.78
Pluchea sericea	6.22	2.23	0.72	1.97	12.05	21.09
Ambrosia dumosa	12.93	3.70	3.37	1.97	4.14	21.09
Bebbia juncea	0.27	1.96		3.17		
Peucephyllum schottii						
TOTAL	69.70	36.13	19.42	34.14	38.05	57.95
Unknowns	3.45	15.88	0.93	0.00	9.80	4.77

* Monthly sample sizes in parenthesis under each month.

Table 2. (continued)

	July (13)	Aug. (3)	Sept. (2)	Oct. (9)	Nov. (6)	Dec. (11)	Annual
GRASSES							
Aristida spp.				1.20	0.32		.24
Muhlenbergia porteri	1.95			4.48	0.16	12.39	1.60
Bromus rubens					0.16		.15
Schismus barbatus						0.28	.54
Tridens pulchellus					0.16		.04
Sorghum spp.		2.38	2.28	7.60	1.96	1.57	1.43
TOTAL	1.95	2.38	2.28	13.28	2.76	14.27	3.17
FORBS							
Eriogonum spp.				3.83	1.30	0.57	1.74
Mirabilis							0.07
Mentzelia spp.							0.03
Oenothera spp.				0.45		0.14	1.09
Langloisia setosissima							0.02
Pectocarya spp.					0.32	0.28	0.05
Amsinkia/Cryptantha	1.29	7.25	5.51	2.89	2.12	5.00	4.64
Mimulus biglovii					3.46	3.94	1.33
Plantago insularis	10.76	6.56	2.94	1.81	3.30	0.57	19.75
Gernea canescens							0.22
Calycoseris wrightii						0.85	0.16
TOTAL	12.05	13.81	8.45	8.98	10.50	11.35	29.09
SHRUBS							
Cercidium floridum	34.24	24.71	18.83	20.56	22.01	15.45	14.96
Cassia armata							0.11
Prosopis spp.	21.28	19.60	11.82	9.14	8.03	5.62	8.36
Acacia greggii		3.03	3.45	11.80	13.74	9.15	4.30
Dalea schottii					3.30	5.47	1.21
Krameria grayi	3.44	2.69		1.36		0.28	2.03
Larrea divaricata			3.62			1.28	0.95

Table 2. (continued)

SHRUBS (continued)	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Sphaeralcea ambigua					1.79	0.28	0.33
Fouquieria splendens	3.11	1.90	2.11		4.50	2.43	2.46
Opuntia acanthocarpa			8.73	2.41	7.31	2.00	3.18
Hyptis emoryi		0.31				0.14	0.22
Lycium andersonii			7.45		7.31	0.70	1.93
Hymenoclea salsola	4.64	5.53	7.09	10.89	8.40	5.94	5.70
Encelia farinosa						2.15	0.73
Pluchea sericea	15.67	18.96	15.08	10.37	1.63		8.83
Ambrosia dumosa		2.22		5.77	4.84	18.30	4.77
Bebbia juncea			1.62			3.49	0.87
TOTAL	82.38	78.95	83.76	72.30	84.49	72.96	61.43
Unknowns	3.62	4.86	5.51	5.44	2.29	1.42	4.84

and when it sprouted and was abundant between February and June, it formed the bulk of the diet (Figure 14). Arrowweed and palo verde gained dominance (each contributing to over fifteen percent of the diet) as the annual forb layer was depleted and as warmer weather kept the burros closer to the river in late May and June. In July and August, mesquite was a principal food item, and Plantago was reduced in importance. This change reflects in part the high temperatures which kept burros in the riparian zone, but also the ripening of the mesquite beans and the paucity of annuals. With the cooler temperatures of autumn, the two riparian species (arrowweed and mesquite) lessened in importance; but palo verdes remained heavily utilized throughout the latter half of the year. The drop in Cercidium in December was compensated for by a marked increase in the consumption of burrobush (Ambrosia dumosa), which had greened in response to a November rainfall. Burrobush amounted to 18.30 percent of the December diet.

The 1974 annual diet of feral burros in the Chemehuevi Mountains consisted of 3.17 percent grasses, 29.09 percent forbs and 61.43 percent browse. Published analyses of burro diets from other localities indicate a lesser dependence on browse than in the Chemehuevis Mountains. From 19 burro stomach samples, Browning's (1960) data reveal the annual diet of burros in Cottonwood Canyon, Death Valley National Monument, to consist of 10.0 percent grasses, 39.00 percent forbs and 51.0 percent browse. More striking differences are seen in

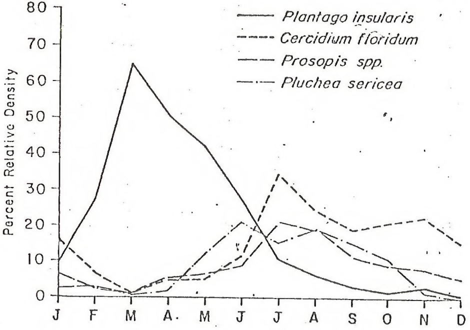


Figure 14. Percent Relative Density of the four major plant species in the diet of burros in the Chemehuevi Mountains, California.

McMichael's (1964) analysis of burro stomach contents (n = 9) collected in the Black Mountains, Arizona, only 25 miles from the Trampas Wash study area. McMichael found the diet to be composed of 1.0 percent grasses, 88 percent forbs and only 11 percent browse species. Hansen and Martin (1973), using the same fecal analysis methods employed in the Chemehuevi study, determined the annual burro diet in the western end of the Grand Canyon, Arizona, to contain 61.0 percent grasses, 11.4 percent forbs and 27.5 percent browse. These variations in diet no doubt reflect differences in the species composition of the plant communities in the different study areas, and also indicate the great versatility of the burro and the unspecialized nature of its food requirements.

Burros probably prefer to graze grasses and forbs, but the nature of the Chemehuevi environment forces them to be predominantly browsers and to be highly opportunistic in their diet. The species diversity in their diet is correlated with the diversity of plants sprouting or quickening in response to the sporadic precipitation. Highest diversities occurred in February, April and December (28, 25 and 27 species respectively). Each of these months was preceded by a month in which some rain fell. Also, each was a relatively cool month in which burros could cover a wide area and visit springs and tinajas near which forbs and grasses are likely to be found. The lowest species diversity in the diet occurred in July and August (10 and 13 respectively), when burros were essentially confined to the river's edge.

Curiously, palo verde did not seem to be preferred in the green, leafy state. Perhaps it is eaten to satisfy some requirement for bulk. Ground observations indicate that most of the palo verde ingested was in the form of yellowed twigs and branches up to an inch in diameter. Nearby green branches were ignored. Similarly, cured burroweed (Hymenoclea salsola) also seems to be preferred over the green material. Burros were observed eating the skeletons of dead cholla (Opuntia acanthocarpa) as well as the live joints.

The dramatic decline in Plantago insularis in the second half of the year does not necessarily reflect a lack of interest in the species by the burros. As seen in Figure 13, burros spent considerable time grazing on the interfluves in the fall and winter months; and Plantago is normally a major component of the bajada vegetation. But depletion of Plantago by burros constantly grazing it was obvious from field observations. Search time must have lengthened greatly as the year progressed and the density of the annual declined. Although fewer hours were spent in the interfluves, it took considerably less time to find and ingest an equivalent amount (by percent dry weight) of palo verde, which came to be the mainstay of the diet as Plantago was depleted.

Sample error may account for some of the rapid decrease in Plantago which occurs in the diet analysis. Plantago is distinguished microscopically by its long, thin trichomes, the number of which decreases as the plant dies and cures. Therefore, plants which might have been one or two years on the interfluves and cropped could have been underestimated. This was thought to be the case in January, especially, since a good Plantago cover remained at that time from the unusually wet winter of 1972-73. However, laboratory tests run with old Plantago specimens did not find a discrepancy in counts of hand compounded samples of known dry weight percentages.

Reproductive Rates

Three collared jennies in the Chemehuevi herd have had second colts since the initiation of research (January 1973). The interval between colts for Female 461, Female ORANGE and Female RED was 14, 16 and 17 months respectively. At this time it seems reasonable to estimate that the 20 to 25 percent recruitment seen in feral burro populations takes place not annually, but somewhere closer to every eighteen months. With 20 percent recruitment every 18 months, the Chemehuevi population, now estimated at about 80 individuals, can be expected to double by 1980 and to surpass 200 animals by 1982, if management and reproductive rates remain the same as in the past 17 months.

Growth Curve

Shoulder height appears to be a good indicator of age in the feral burro. Full growth is not achieved until sometime after two years of age (Figure 15). This criterion appears to be accurate for individuals checked in one locality in New Mexico, two in Arizona, and one in California. Sexual maturity is reached before full growth. The growth rate may be attuned to the maturation rate of the ancestral African

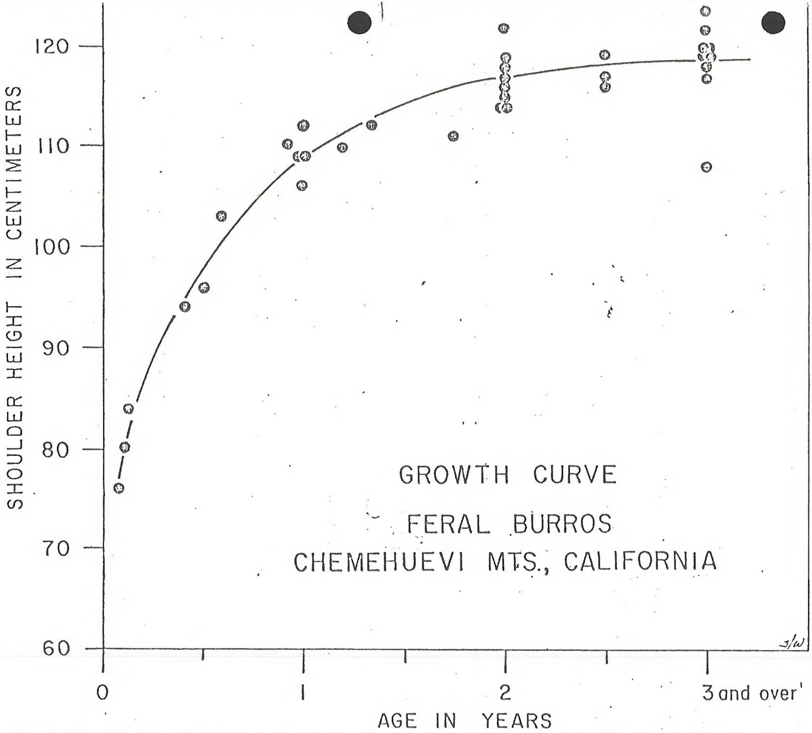


Figure 15. Shoulder height as a criterion for ageing young burros between 0 and 18 months.

ass (Equus asinus africanus), in which males become sexually mature between three and five years of age and females at two (Heinz Heck, pers. comm.).

General Observations

Burro sightings were much more sporadic in the winter and spring of 1975 than during the same seasons the previous year. Burros appeared to be moving around much more and to be using areas farther from the river (3 to 8 miles). No large (> 10) burro groups were encountered. These conditions are attributed to the depletion of the range (winter annuals) and the absence of restorative rains during the winter.

Burros spent more time in the washes than during the previous year; but when annuals sprouted they returned to heavy use of the interfluves. In mid-June, after a week of daily maximum temperatures in excess of 110° F, burros began congregating in the major washes within a mile and a half of the Colorado River. At this time Male ORANGE' was seen within the territorial limits he occupied last summer. This hot weather was followed by a week of unseasonably cool temperatures (daily maximums of 90° to 100°), and most burros including ORANGE', again dispersed.

Bill Williams Mountains

Mr. Seegmiller has completed seven months of field research in the Bill Williams Mountains and is in the process of analyzing the data on movements, food habits and reproduction. Also, monthly fecal samples have been collected for sheep and burros throughout most of 1974, and the results of this analysis plus Seegmiller's findings will be presented in the next report.

Kofa Mountains

Eight radio-collars and 100 color-collars are ready for instrumenting animals in the Kofa Game Range. Enough of the marking will be completed by 1 August 1975; and will permit Ms. Woodward to begin her studies as soon as the Bureau of Land Management provides a trailer at Quartzsite. An aerial survey will be flown in late August and more marking will be undertaken the latter part of 1975. It is planned with the cooperation of the Department of Arizona Game and Fish, that five bighorn sheep (3 ewes and 2 rams) will be radio-collared as well.

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